"light pipe" backlight designs, to diffuse the spotted distribution of light emanating from the permanently formed diffusion dot pattern on the rearward surface facing towards the reflective surface disposed behind the light guiding panel.

[0015] The combination of the light guiding panel, fluorescent light tubes, diffusing sheets and the reflective layer together produce a plane of backlight having a uniform spatial intensity for illumination of the LCD panel affixed to the backlighting panel.

[0016] Transflective display constructions are employed in most PDA devices due to their reduced power storage capabilities and their need to function in outdoor and/or bright ambient light conditions.

[0017] PDA devices may be generally characterised therefore as having a shortage of display/input interface area and a limited ability to operate power intensive devices such as high luminance emissive displays.

[0018] One means of addressing the shortage of display/input interface area is by overlaying a further transparent display pane over the existing PDA display. This type of technology (as described in the applicants co-pending applications PCT/NZ98/00098 and PCT/NZ99/00021, incorporated herein by reference) enables, by various means, the stacking of image planes at set distances. These configurations provide intrinsic motion parallax, where the x and y distance changes between objects displayed on different planes depending on viewing angle, binocular depth cues and separate focal planes that may be brought in and out of focus depending on where the viewer fixes his or her attention.

[0019] However, the addition of a further display screen overlaying the existing screen of a PDA type device results in a significantly darkened combined display. This is due in part to the intrinsic attenuation of light passing through the additional layers of the additional display and to the unpracticality of increasing the backlighting luminance due to the power constraints discussed above.

[0020] There is therefore a need to provide an enlarged display area of PDA type devices (as hereinbefore defined) without incurring a detrimental loss in display brightness.

[0021] All references, including any patents or patent applications, cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the reference states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications may be referred to herein, this reference does not constitute an admission that any of these documents forms parts of the common general knowledge in the art in any country.

[0022] It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

DISCLOSURE OF INVENTION

[0023] According to one aspect of the present invention there is provided a method of adapting a visual display unit having a first screen in a first focal plane by the addition of one or more at least partially transparent display screens at least partially overlapping said first screen and located in focal planes distinct from said first focal plane, characterised in that

[0024] an at least partially transparent emissive layer is provided between said first screen and at least one said additional display screen.

[0025] As used herein, the term 'emissive layer' includes any optical component capable of emitting light when stimulated by an external input, whether electrical, optical, mechanical, magnetic or other.

[0026] As used herein, the term 'visual display unit' includes, but is not limited to personnel digital assistants (PDA), computing means—including portable and/or hand held, devices, mobile phones, watches, calculators, data loggers, cameras, instrument displays, televisions, and any other electronic display means.

[0027] According to a further embodiment, there is provided visual display unit produced by the above-described method.

[0028] According to a still further aspect of the present invention there is visual display unit having two or more at least partially overlapping display screen located in distinct focal planes, at least one said screen being at least partially transparent; characterised in that an at least partially transparent emissive layer is provided between said screens.

[0029] It may be seen therefore, that a visual display unit such as a PDA may be adapted to incorporate multi focal plane displays and an emissive layer either at the initial manufacturing stage, or retro-fitted as a separate accessory.

[0030] According to one aspect of the present invention, said emissive layer is a sheet with substantially planar opposed upper and a lower surfaces and a peripheral boundary of a prescribed thickness, said sheet formed from a material such that light rays incident from said peripheral boundary are retained between the said planar surface through total internal refraction at angles less than a critical angle.

[0031] Preferably, at least one said sheet planar surface has a plurality of defined features located thereupon capable of refracting a said retained light ray incident on a said feature through an angle greater than the said critical angle of total internal reflection sufficient to exit said sheet via one of said planar surfaces.

[0032] Preferably, said features include diffusion dots, predetermined scratches, indentations grooves, protrusions, regular or irregular undulations and the like.

[0033] Preferably, at least one light source such as cold cathode fluorescent tube is located along said peripheral edge.

[0034] In an alternative embodiment, said light source is an array of light emitting diodes.

[0035] Preferably, said emissive layer is configured to refract the ray axis of light at the said peripheral border such that the peripheral border between adjacent screens is not visible along said viewer's sightline.

[0036] According to one aspect of the present invention, the said features are distributed with an increasing density as a function of distance (e.g. a quadratic function) from said light source.